MOLECULAR SPECTRA OF RbSr: HELIUM DROPLET ASSISTED PREPARATION OF A DIATOMIC MOLECULE

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We report on the first spectroscopic investigation of the ground and excited states of RbSr. The molecules are prepared in their vibronic ground state ($X^2\Sigma^+_{1/2}, \nu'' = 0$) in a sequential pickup process[a] on the surface of helium nanodroplets, confined in a cold (0.38 K) and weakly perturbing superfluid environment[b]. Utilizing resonance-enhanced multi-photon ionization time-of-flight (REMPI-TOF) spectroscopy and laser induced fluorescence (LIF) spectroscopy our investigations cover the spectral regime of 11500 cm^{-1} - 23000 cm^{-1}. The weak interaction between molecules and helium droplets causes a broadening of the observed transitions. For spectrally resolved band systems the helium droplet isolation approach facilitates the determination of molecular constants. Our assignment is assisted by theoretical calculations of potential energy curves based on a multireference configuration interaction (MRCI) approach. Several strong transitions could be identified; the most prominent spectral feature is a vibrational resolved band system at 14000 cm^{-1}. In contrast to the excitation spectra, dispersed fluorescence (DF) spectra are not influenced by the helium environment, because the molecules leave the droplets upon photoexcitation, revealing detailed insights into the electronic structure of the free RbSr molecule.

Our experiments will aid the ongoing search for optimal pathways for the preparation of ultracold ground state RbSr molecules[c,d].

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